4.0 Management of Urban Runoff within the La Jolla Shores Coastal Watershed

4.1 Urban Runoff Characterization

The La Jolla Shores Coastal Watershed drains into two Areas of Special Biological Significance (ASBS), the San Diego Marine Life Refuge and the La Jolla Ecological Reserve. In order to reduce constituents of concern (COC) from entering the ASBS, baseline information regarding COCs within the La Jolla Shores Coastal Watershed was collected in order to monitor contaminant levels and to determine structural and non-structural Best Management Practices (BMPs) that would be effective in reducing COCs.

This baseline data collection included a review of existing information within the watershed and within the region, as well as a comparison between the La Jolla Shores ASBS and other ASBS. In addition to the data review, a wet weather season sampling and monitoring plan was developed in order to obtain current water quality and flow information. The wet weather season samples collected were chemically analyzed for COCs defined in the Ocean Plan, including constituents that had not been previously monitored, and compared against water quality objectives.

Compilation of baseline information also consisted of defining and calculating loadings of elevated and potentially elevated COCs, based upon analytical results from field sampling, as well as upon previous study results from areas with similar land uses. Lastly, monitoring data from Scripps Institution of Oceanography (SIO) during the 2004-2005 wet season was evaluated and incorporated into BMP strategies.

4.1.1 Watershed and ASBS Background Information

The La Jolla Shores Coastal Watershed is located within the community of La Jolla, California, adjacent to the University of California San Diego (UCSD). The watershed is contained within the Scripps Hydrologic Area (HA 906.30). The boundaries of the watershed are shown in Figure 4-1.

Figure 4-1. La Jolla Shores Coastal Watershed boundaries.

Areas of Special Biological Significance (ASBS)

The receiving waters in the area of SIO Pier were designated a Marine Wildlife Refuge in 1929 by California Department of Fish and Game (CDFG). CDFG altered the designation to a Marine Protected Area (MPA) in 1957, and renamed the area the San Diego – Scripps State Marine Conservation Area. In 1974 the Scripps State Marine Conservation Area was split into two areas and renamed the San Diego Marine Life Refuge and La Jolla Ecological Preserve. Each of these was included on a list of 31 Areas of Special Biological Significance (ASBS) throughout the state of California by the State Board.

Under the ASBS designation, discharges into an ASBS are prohibited if the discharge alters the receiving water's natural water quality characteristics. There are currently 92 direct discharges (mostly from pipes and weep holes through sea walls) into the ASBS. The vast majority of these originate from privately owned homes. Waste water discharges from SIO are commingled with urban runoff within the storm drain system.

Scripps Discharges

Scripps Institution of Oceanography was founded in the early twentieth century and has been discharging waste seawater into the ocean in the vicinity of its pier since 1910. SIO discharges wastes associated with its seawater system pursuant to Order No. 99-83, National Pollutant Discharge Elimination System (NPDES) permit No. CA0107239.

The seawater system at Scripps has the capacity to pump approximately 1.25 million gallons per day of seawater from an intake pump located on the seaward end of SIO Pier. The seawater is filtered through high-speed sand filters located at the foot of SIO Pier and is stored in two concrete storage tanks located near the filters with any overflow water discharged across the beach near the foot of the pier. The filtered water is delivered to the laboratories and aquaria of SIO, the Stephen Birch Aquarium-Museum, and the National Marine Fisheries Service aquaria. After circulation through the various aquaria, the water is discharged back into the ocean at two outfalls. SIO also discharges waste from the intake flume and from the storage tank after filtering the backwash. In 2004 the seawater system discharges into the municipal storm water system were discontinued. The discharges flow across the beach into the *San Diego Marine Life Refuge*, an area designated by the State Water Resources Control Board (State Board) as an *Area of Special Biological Significance* (ASBS). Effluent discharged from SIO must be essentially free of:

- Floatable materials or materials that will become floatable upon discharge .
- Settleable materials or substances that may form sediments which will degrade benthic communities or other aquatic life.
- Substances that will accumulate to toxic levels in marine waters, sediments, or biota.
- Substances that significantly decrease the natural light to benthic communities and other marine life.
- Materials that result in aesthetically undesirable discoloration of the ocean surface.

Permitting

Basin Plan

A document entitled "Comprehensive Water Quality Control Plan Report, San Diego Basin (9)" was adopted by the Regional Board on September 8, 1994. This is commonly referred to as the Basin Plan and established the following beneficial uses for the Pacific Ocean:

- Industrial Service Supply
- Navigation
- Water-contact Recreation
- Non-contact Water Recreation
- Commercial and Sport Fishing
- Preservation of Biological Habitats of Special Significance
- Wildlife Habitat
- Rare, Threatened, or Endangered Species
- Marine Habitat
- Aquaculture
- Migration of Aquatic Organisms
- Spawning, Reproduction, and/or Early Development, and
- Shellfish Harvesting

Ocean Plan

The 2001 Ocean Plan prohibits the discharge of wastes to areas designated as ASBS, unless an exemption is granted from the State Board. SIO filed for an exemption in 2002 and received a conditional exception to the Ocean Plan in July, 2004.

NPDES

Waste Discharge Requirements were initially issued by the San Diego Regional Water Quality Control Board (RWQCB) on September 30, 1969 and were first issued to SIO on September 16, 1974. This permit was then reissued in 1979, 1984, 1994, and 1999. The current SIO permit (NPDES Permit No. CA017239) was received on February 9, 2005 and expires on February 9, 2010.

4.1.2 Similar Areas of Special Biological Significance

The Morro Bay ASBS, located in a shallow lagoon midway between Los Angeles and San Francisco, has similar water quality concerns as the La Jolla Shores ASBS. These water quality issues include sedimentation, nutrient enrichment, bacterial contamination, and heavy metal contamination. Sedimentation in Morro Bay has resulted in a reduction of approximately 25 percent of the tidal capacity of the bay while bacterial contamination has forced the closure of many of the shellfish growing beds. The predominant sources of bacteria in Morro Bay are urban runoff, failing septic systems, agriculture, and recreational boaters. Agriculture, urban runoff, septic systems, and animal waste are also responsible for increased nitrate and phosphate levels within the surface waters of the ASBS and lead to algal blooms and dissolved oxygen levels that fall below Basin Plan water quality objectives. Abandoned mines in the upper watershed have lead to heavy metal contamination (chromium and nickel) via sediment transport into Morro Bay while offshore boatyard have contributed high levels of mercury and other metals to the sediments.

Several groups such as Friends of Morro Bay, Morro Bay National Estuary Program's Volunteer Monitoring Program, and Morro Bay On-Farm Coastal Water Quality Implementation Project (Project Clearwater) have sought to monitor, restore, and enhance the water quality of the Morro Bay ASBS. The Morro Bay Estuary Program tracks long-term trends in the watershed and is a primary component of monitoring Los Osos Creek, Chorro Creek, and Morro Bay for the purpose of implementing TMDLs that are currently being developed. Project Clearwater provides technical assistance and cost-sharing funds for landowners to install BMPs for the purpose of reducing sediment, nutrient, and bacterial inputs to Morro Bay. Land owners are encouraged to write individual conservation plans and participate in "short-courses" on roles they can play in reducing anthropogenic impacts to the ASBS.

4.1.3 Monitoring Program

A water quality monitoring strategy was designed and implemented by Weston Solutions, in concert with the City of San Diego, in order to obtain baseline water quality data for urban runoff entering into the ASBS known as the La Jolla Ecological Reserve. About 75% of the runoff within the watershed (16.8 million cubic feet) was discharged by two storm drain outfalls in two sub-drainage areas. The two storm drain outfalls were sampled during the 2005-2006 wet weather monitoring season and are depicted in Figure 4-2. The northern outfall (D1) is located due west of the intersection of El Paseo Grande and La Jolla Shores Drive, while southern outfall (D2) is due west of the intersection of La Vereda and Avenida de la Playa (Figure 4-2). Water falling within these two drainages eventually reaches the beach at La Jolla Shores and flows into the La Jolla Ecological Reserve.

The sampling design consisted of installing a mass loading station within each of the two sub-drainage areas in order to properly characterize the COC loading occurring upstream of the ASBS under two slightly different land use regimes. Mixing zone grab samples were taken to determine COC concentrations in the immediate area of discharge, while offshore sampling directly outside of the fresh/salt water mixing zone was also incorporated into the sample design in order to characterize COC levels within the ASBS and to compare these levels to defined exceedance values in the California Ocean Plan.

Water quality sampling was performed at two sampling stations within the municipal storm sewer system (MS4). Automated flow equipment was installed within the manholes of the MS4 at locations S1 and S2 in Figure 4-2. The northern sampling station (S1) was located on El Paseo Grande near its intersection with La Jolla Shores Drive, while the southern sampling station was located on the northeast corner of La Jolla Shores Drive and Paseo Dorado (S2).

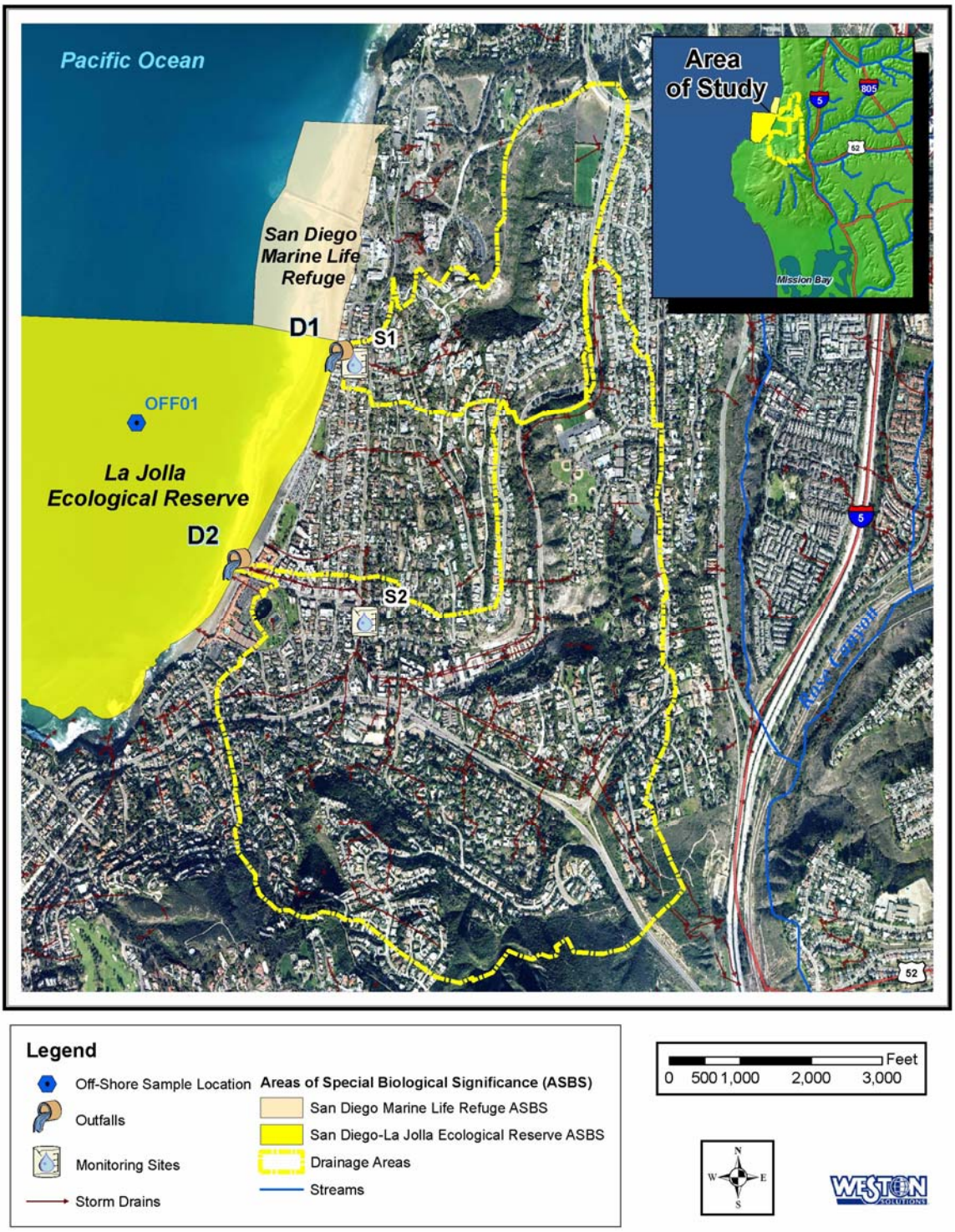

Figure 4-2. The two main sub-drainage areas within the La Jolla Shores Coastal Watershed drainage area.

Ocean outfall/mixing zone samples were collected within the mixing zone, as defined in the California Ocean Plan, at the outfalls to the storm drains downstream of where the storm water samples were collected. Locations of the mixing zone samples are depicted in Figure 1. The northern mixing zone sample location (D1) was at the ocean outfall due west of the intersection of El Paseo Grande and La Jolla Shores Drive, while the southern mixing zone sample location was at the ocean outfall due west of the intersection of La Vereda and Avenida de la Playa. The offshore sampling location (OFF01) was located due west of the La Jolla Shores Beach parking lot (approximately 2200 feet from shore) and is depicted in Figure 4-2.

Sample Frequency

The urban runoff and ocean mixing zone samples were collected during storm events occurring in San Diego's designated wet season (October 1 through April 30). Although only one storm event was scheduled to be sampled during the 2005-2006 wet season per the QAPP for the La Jolla Shores Coastal Watershed Management Plan (City of San Diego, 2006), previous storm sampling conducted by The City of San Diego in March and April of 2005 was included as part of the overall dataset for the Watershed Management Plan. Sampling of water entering the ASBS from Birch Aquarium and SIO outfall pipes was conducted by SIO as part of their discharging permit requirements and was also incorporated into the dataset.

A storm event was considered viable for monitoring activities if it exceeded 0.10 inches of rainfall. Flow-weighted composite samples were collected of the initial flush of urban runoff following a storm event from the two automated sampling stations. Flow within the MS4 was monitored and recorded at the sampling stations to provide accurate flow data for the purpose of calculating load estimations.

Samples from the two ocean mixing zone sites (D1 and D2) were collected on a time-weighted basis at the outfalls of the sub-drainage areas. The time-weighted samples were collected over the portion of the storm during which storm water samples were collected, but at set and equal intervals. Both the flow-weighted and time-weighted samples were separately composited prior to chemical and biological toxicity testing. For more detailed descriptions of sampling methods used for this study, see the QAPP (City of San Diego, 2006).

During the 2005-2006 wet weather monitoring season sampling was conducted on February 19, 2006 at Storm Drain sites S1 and S2, mixing zone sites D1 and D2 and the offshore sampling location. During the 2004-2005 wet season, one sampling event was conducted at S1 (4/28/05) and two sampling events were conducted at S2 (3/23/05 and 4/28/05) by The City and analyzed in the same manner as the 2006 samples. Results from each of these sampling events are included in the data summary tables presented in Section 4.1.4.

Sample Analyses

Sixty liters of water were collected at each sample location in multiple containers, mixed thoroughly and composited into sterile containers in Weston's laboratory, and partitioned

into appropriate sample containers for delivery to the chemistry laboratory. The flow-weighted storm water composite samples, the time-weighted mixing zone composite samples, and the offshore composite samples were analyzed for the constituents listed below in Table 4-1:

Table 4-1. Chemical constituents for which laboratory analyses were performed.

• Total Hardness as $CaCO_3$ • Total Suspended Solids (TSS) • Total Dissolved Solids (TDS) • Settleable Solids (SS) • Total Organic Carbon (TOC) • Turbidity • Ammonia • Total Kjeldahl Nitrogen (TKN) • Nitrate as N	• Nitrite • Total Phosphorus • Orthophosphate (as P) • Total Cyanide • Total and Dissolved Metals • Synthetic Pyrethroids • Organophosphorus Pesticides • Organochlorine Pesticides/PCBs • Semi-Volatile Organic Compounds

Grab samples were collected for those constituents that are not conducive to composite sampling. These included pH, temperature, conductivity, oil and grease, and bacteriological indicators. The bacteriological indicators for which analyses were performed included total coliforms, fecal coliforms, and enterococci. All grab samples were collected in the manner described in the approved QAPP. In addition to conducting analyses for those constituents listed above and presented in Table 4-1, acute and chronic toxicity testing was also conducted on urban runoff samples in order to assess possible toxic impacts to mysid shrimp, giant kelp, and sea urchins.

4.1.4 Results

Results of rainfall totals, chemical analyses, bacterial analyses, and toxicity bioassays from wet weather sampling events occurring from March, 2005 through April, 2006 in the La Jolla Shores watershed are discussed below.

Rainfall Events and Estimated Discharge Volumes

Rainfall totals in inches for each sample event and the respective discharge volumes in cubic feet are presented below in Table 4-3. Discharge volumes from each drainage basin as well as the watershed's total discharge volume entering the La Jolla Ecological Reserve are also provided in Table 4-3. Discharge volumes were calculated using ArcGIS based upon the percentage of impervious surface area within the land area. The annual volume of runoff entering the La Jolla ASBS through the S2 storm drain outfall was 12.8 million cubic feet of water while runoff entering the ASBS through the S1 storm drain outfall was approximately 4 million cubic feet of water. Overall, the annual volume of runoff entering the La Jolla Shores ASBS was calculated to be slightly greater than 22 million cubic feet of water less a small amount of surface flow from an unmonitored area between the two sub-drainages. During dry weather, storm drains are

diverted into the sewer system, and thus, only low amounts of runoff would be expected to reach the ASBS.

Table 4-3. Rainfall and Runoff Volume Calculations for La Jolla ASBS.

Constituent	Impervious	Acres	Units	La Jolla ASBS				
				03/23/05	04/28/05	02/19/06	05-06 Season	Average Annual
Rainfall (Seaworld)	-	-	inches	0.31	0.43	0.18		11
Rainfall (Miramar)	-	-	inches	0.24	0.57	0.34		13
Rainfall (SAN)	-	-	inches	0.53	0.51	0.19	4.6	10.5
S1 Volume	0.45	215	ft3	126,901	177,426	83,425	1,621,510	4,053,774
S2 Volume	0.36	853	ft3	401,328	561,116	263,836	5,128,081	12,820,204
Total Preserve Volume	0.37	1452	ft3	694,695	971,286	456,698	8,876,657	22,191,642

4.1.4.1 Chemistry Results

Chemical analyses from the three sampling events are presented in Table 4-4. Because samples collected within the MS-4 were freshwater in nature, their values were compared against San Diego Basin Plan water quality standards, while the mixing zone and offshore samples were considered salt water and were therefore compared against the California Ocean Plan water quality standards. Values highlighted in yellow in Table 4-4 exceeded San Diego Basin Plan water quality criteria and values highlighted in green exceeded California Ocean Plan water quality criteria. A brief discussion of each analyte category for which analyses were performed is provided below. Emphasis is placed on those analytes detected at elevated levels within the MS4 leading into the ASBS, as well as within the mixing zone and the offshore waters of the ASBS.

Metals

Total Metals

Total Copper concentrations were detected in both S1 and S2 samples (31.3 and 36.6 µg/L, respectively) on 2/19/06 at levels that exceeded the Basin Plan water quality criteria (less than 30.5 µg/L). Total copper concentrations at the two mixing zone locations (7.83 µg/L and 5.36 µg/L at D1 and D2, respectively) and the offshore location (10.1 µg/L) were significantly below the Ocean Plan criteria of less than 30.0 µg/L. No other total metal concentrations were above Basin Plan or Ocean Plan standards. Two other metal concentrations (lead and zinc) were somewhat elevated in samples collected within the MS4 at sites S1 and S2. Total lead was detected at concentrations of 10.2 µg/L and 6.9 µg/L at S1 and S2, respectively, and was below the Basin Plan criteria of less than 18.58 µg/L. Similarly, total zinc was detected at concentrations of 95.6 and 77.7 µg/L at S1 and S2, respectively; values significantly below the Basin Plan criteria of less than 387.8 µg/L. While low levels of total lead were detected at the D2 mixing zone

sample (2.8 μg/L), no total lead was detected in either the offshore sample or in the D1 mixing zone sample.

Dissolved Metals
Dissolved Copper concentrations were detected in S1 and S2 samples collected in 2005 at levels that exceeded Basin Plan water quality criteria. Samples collected from the MS4 in 2006, however, did not exceed Basin Plan standards for dissolved copper. No dissolved copper was detected in mixing zone or offshore samples. Other than copper, no other dissolved metals exceeded either Basin Plan or Ocean Plan criteria.

Analysis of bioaccumulated metals was performed by The City for the purpose of assessing the impact of storm water discharges on the health of the ASBS ecosystem. Specifically, the study assessed the accumulation of metals in the tissue of mussels and sand crabs. For a description of the methods and results of the bioaccumulation study see Section X.

Polynuclear Aromatic Hydrocarbons (PAHs)
No PAHs were detected in any of the samples collected over all three sample events (Table 4-4). The method detection limits provided for PAHs did not allow for the evaluation of the Ocean Plan water quality criteria of 0.0088 ug/L. This criteria is based upon a 30-day sample average rather than an instantaneous maximum. The method detection limits, however, were within the range of the minimum levels recommended by the Ocean Plan and were provided in the approved QAPP that was reviewed by the SWRCB.

Analysis of bioaccumulated PAHs was performed by The City for the purpose of assessing the impact of storm water discharges on the health of the ASBS ecosystem. Specifically, the study assessed the accumulation of PAHs in the tissue of mussels and sand crabs. For a description of the methods and results of the bioaccumulation study see Section X.

Turbidity
According to the Basin Plan, turbidity within the Scripps hydrologic area is not to exceed 20 NTU more than 10 percent of the time during any one year period. Turbidity measurements of the MS4 on the three sampling dates ranged from 110 NTU to 133 NTU at S1 and from 42 NTU to 93 NTU at S2 (Table 4-4). Mixing zone samples and the offshore sample all measured below 2.5 NTU and met the Ocean Plan criteria of less than 225 NTU.

Oil and Grease
Oil and grease were detected in storm drain samples, mixing zone samples, and the offshore sample collected on 02/19/06 (Table 4-4). Oil and grease concentrations ranged from 2.68 mg/L to 4.08 mg/L in the storm drains, 1.42 mg/L to 2.27 mg/L in the mixing

zones, and were 2.38 mg/L in the offshore sample. However, there were no exceedances of the Ocean Plan's water quality criteria.

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Field Measurements												
pH			0.1			7.1	7.0	7.62		7.2	7.2	
Temperature			0	°C		11.6	13.5	16.6		12.4	13.7	
Conductivity (µS/cm)			1	µS/cm		620	46090	644		464.2	45810	
General Laboratory Measurements												
Total Hardness as CaCO3												
Total Suspended Solids (TSS)	see plan		1.6	mg/L	308	200	6.5	315	150	94	10.8	2
Total Dissolved Solids (TDS)			42	mg/L		818	35500			314	33700	34900
Settleable Solids (SS)	3		0.1	ml/l		0.3	ND			0.2	ND	ND
Total Organic Carbon (TOC)			1	mg/L		10.7	1.11			16.6	5.15	1.95
Oil & Grease	75		1.4	mg/L		4.08	1.42			2.68	2.27	2.38
Turbidity	225	>10% natural	0.05	NTU	133	110	1.94	93	57	42	2.49	0.304
Ammonia (as N)	6		0.2	mg/L	0.89	0.6	0.3	0.94	1.1	0.6	0.3	0.3
Total Kjeldahl Nitrogen (TKN)			1.6	mg/L		4.44	2.08			3.09	2.92	2.15
Nitrate as N			0.04	mg/L		4.34*	2*			8.05*	1.96*	ND*
Nitrite			0.005	mg/L		0.018	0.011			0.042	0.011	0.01
Total Phosphorus			0.009	mg/L		0.798	0.136			0.691	0.047	0.031
Orthophosphate as P			0.2	mg/L		ND*	ND*			2.2*	ND*	ND*
Chromium+6	0.02		-	mg/L								
Total Cyanide	10		0.002	mg/L		ND	ND			ND	ND	ND
Total Trace Metals												
Aluminum (Al)			6.6	µg/L		5940	794			776	632	719
Antimony (Sb)		10	1.015	µg/L		ND	ND			ND	ND	ND
Arsenic (As)	80	50	0.4	µg/L		13.7	1.16			2.76	1.36	1.22
Barium (Ba)			0.02	µg/L		52.8	4.32			32.9	4.29	4.05
Beryllium (Be)			0.04	µg/L		ND	ND			ND	ND	ND

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Cadmium (Cd)	10	7.31	0.195	µg/L		ND	ND			ND	ND	ND
Chromium (Cr)	20	644.2	0.189	µg/L		8.3	1.19			1.91	1.77	ND
Cobalt (Co)			0.162	µg/L		5.47	2.4			2.25	2.1	1.72
Copper (Cu)	30	30.5	0.393	µg/L		31.3	7.83			36.6	5.36	10.1
Iron (Fe)			0.785	µg/L		7030	174			691	200	53.5
Lead (Pb)	20	18.58	1.384	µg/L		10.2	ND			6.9	2.8	ND
Manganese (Mn)			0.049	µg/L		497	4.79			50	3.51	1.34
Mercury (Hg)	0.4		0.09	µg/L		ND	ND			ND	ND	ND
Molybdenum (Mo)			0.122	µg/L		0.85	7.31			2.1	6.58	5.49
Nickel (Ni)	50	168.5	0.268	µg/L		9.91	2.63			3.5	2.19	2.13
Selenium (Se)	150		0.28	µg/L		1.13	ND			1.37	ND	ND
Silver (Ag)	7		0.156	µg/L		ND	0.19			ND	ND	0.17
Thallium (Tl)			1.806	µg/L		ND	ND			ND	ND	5.3
Tin (Sn)			1.5	µg/L		ND	ND			ND	ND	2.1
Vanadium (V)			0.476	µg/L		21.5	ND			4.78	ND	ND
Zinc (Zn)	200	387.8	0.544	µg/L		95.6	11.1			77.7	13.5	5.39
Dissolved Trace Metals**												
Aluminum (Al)			6.6	µg/L	9080	193	684	11100	3270	97.3	717	821
Antimony (Sb)			1.015	µg/L	ND	ND	ND	ND	1.1	ND	ND	ND
Arsenic (As)		340	0.4	µg/L	7.98	1.11	1.18	4.29	3.24	1.43	1.13	1
Barium (Ba)			0.02	µg/L	61.6	16.6	3.99	86.5	64.5	24	3.76	4.89
Beryllium (Be)			0.04	µg/L	ND	ND	0.156	ND	ND	ND	0.146	0.158
Cadmium (Cd)		6.22	0.195	µg/L	ND	1.22	ND	ND	ND	ND	ND	ND
Chromium (Cr)		203.6	0.189	µg/L	10.9	ND	ND	13.7	6.54	ND	ND	ND
Cobalt (Co)			0.162	µg/L	5.38	ND^	1.73^	5.49	2.75	2.05^	1.69^	2.28^
Copper (Cu)		29.3	0.393	µg/L	44.7	4.4	ND	56.1	57.1	22.2	ND	ND
Iron (Fe)			0.785	µg/L	9060	ND	ND	11500	3310	ND	59.6	20.4
Lead (Pb)		10.95	1.384	µg/L	4.2	ND	ND	3.6	2.5	ND	3	ND
Manganese (Mn)			0.049	µg/L	367	12.6	0.781	197	96.8	7.09	1.2	0.301

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Mercury (Hg)			0.09	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)			0.122	µg/L	1.06	3.64	5.87	2.15	0.62	1.6	7.65	8.28
Nickel (Ni)		168.2	0.268	µg/L	6.46	4.74	0.32	9.97	7.53	2.53	ND	0.75
Selenium (Se)			0.28	µg/L	0.704	0.451	ND	3.88	8.62	1.27	ND	ND
Silver (Ag)			0.156	µg/L	ND	0.77	ND	0.384	ND	0.56	ND	ND
Thallium (Tl)			1.806	µg/L	ND	11.4	8.35	ND	ND	14.2	16.9	9.1
Tin (Sn)			1.5	µg/L		3.8	ND			ND	ND	ND
Vanadium (V)			0.476	µg/L	24.4	2.28	ND	31.9	11.8	3.35	0.67	ND
Zinc (Zn)		379.3	0.544	µg/L	76.9	51.7	6.44	188	101	54.3	4.75	39.3
Synthetic Pyrethroids												
Allethrin			1	µg/L		ND	ND			ND	ND	ND
Bifenthrin			1	µg/L		ND	ND			ND	ND	ND
Cyfluthrin			1	µg/L		ND	ND			ND	ND	ND
Cypermethrin			1	µg/L		ND	ND			ND	ND	ND
Danitol			1	µg/L		ND	ND			ND	ND	ND
Deltamethrin			5	µg/L		ND	ND			ND	ND	ND
L-Cyhalothrin			1	µg/L		ND	ND			ND	ND	ND
Permethrin			1	µg/L		ND	ND			ND	ND	ND
Prallethrin			1	µg/L		ND	ND			ND	ND	ND
Organochlorine Pesticides & PCBs												
4,4'-DDD			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4'-DDD			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4'-DDE			100	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4'-DDT			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT			50	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin			60	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
BHC-alpha			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
BHC-beta			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
BHC-delta			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
BHC-gamma			10	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane-alpha			30	ng/L	ND	ND	ND	ND	ND	30E	ND	ND
Chlordane-gamma			80	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
cis-Nonachlor			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin			50	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan-I			30	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan-II			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endrin			50	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Ketone				ng/L								
Heptachlor			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor			60	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Mirex			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Oxychlordane			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
trans-Nonachlor			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde			20	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene			4000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor PCBs												
Aroclor 1016			4000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221			4000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232			4000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242			4000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248			2000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254			2000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260			2000	ng/L	ND	ND	ND	ND	ND	ND	ND	ND
Organophosphorus Pesticides												
Bolstar (Sulprofos)			0.07	µg/L		ND	ND			ND	ND	ND

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Chlorpyrifos			0.03	µg/L		ND	ND			ND	ND	ND
Demeton			0.15	µg/L		ND	ND			ND	ND	ND
Diazinon			0.03	µg/L		ND	ND			ND	ND	ND
Dichlorvos			0.05	µg/L		ND	ND			ND	ND	ND
Dimethoate			0.04	µg/L		ND	ND			ND	ND	ND
Disulfoton			0.02	µg/L		ND	ND			ND	ND	ND
Ethoprop (Ethoprofos)			0.04	µg/L		ND	ND			ND	ND	ND
Fenchlorophos (Ronnel)			0.03	µg/L		ND	ND			ND	ND	ND
Fensulfothion			0.07	µg/L		ND	ND			ND	ND	ND
Fenthion				µg/L								
Malathion			0.03	µg/L		ND	ND			ND	ND	ND
Merphos			0.09	µg/L		ND	ND			ND	ND	ND
Methyl Parathion			0.03	µg/L		ND	ND			ND	ND	ND
Mevinphos (Phosdrin)			0.3	µg/L		ND	ND			ND	ND	ND
Phorate			0.04	µg/L		ND	ND			ND	ND	ND
Tetrachlorvinphos (Stirofos)			0.03	µg/L		ND	ND			ND	ND	ND
Tokuthion			0.06	µg/L		ND	ND			ND	ND	ND
Trichloronate			0.04	µg/L		ND	ND			ND	ND	ND
Semi-volatile Organic Compounds												
Polynuclear Aromatic Hydrocarbons (PAHs)**												
1-Methylnaphthalene			2.18	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylphenanthrene			6.29	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,3,5-Trimethylnaphthalene			4.4	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dimethylnaphthalene			3.31	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene			2.25	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene			2.2	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene			2.02	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene			4.04	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[a]anthracene			7.68	µg/L	ND	ND	ND	ND	ND	ND	ND	ND

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Benzo[a]pyrene			6.53	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[b]fluoranthene				µg/L								
Benzo[e]pyrene			7.67	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene			6.5	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[k]fluoranthene			7.36	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Biphenyl			2.43	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene			7.49	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo[a,h]anthracene			6.19	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzothiophene				µg/L								
Fluoranthene			6.9	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene			2.43	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Indeno[1,2,3-c,d]pyrene			6.27	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene			1.52	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Perylene			6.61	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene			4.15	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene			3.55	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutral Extractable Compounds												
1,2,4-Trichlorobenzene			1.44	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene			1.63	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene			1.65	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene			2.3	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene			1.49	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene			1.93	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine			2.43	µg/L	ND			ND	ND			
2-Chloronaphthalene			2.41	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenylphenylether			4.04	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenylphenylether			3.62	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Azobenzene				µg/L								
Benzidine			-	µg/L	ND			ND	ND			

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
bis(2-Chloroethoxyl)methane			1.57	µg/L		ND	ND			ND	ND	ND
bis(2-Chloroethyl)ether			2.62	µg/L		ND	ND			ND	ND	ND
bis(2-Chloroisopropyl)ether			8.95	µg/L		ND	ND			ND	ND	ND
Hexachlorobenzene			4.8	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene			2.87	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene			-	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane			3.55	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene			1.52	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine			1.63	µg/L		ND	ND			ND	ND	ND
N-Nitrosodiphenylamine			2.96	µg/L		ND	ND			ND	ND	ND
Phthalates												
bis(2-Ethylhexyl) Phthalate			10.43	µg/L	ND	10.43E	10.43E	ND	ND	ND	ND	ND
Butylbenzyl Phthalate			4.77	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Dibutyl Phthalate			6.39	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl Phthalate			6.97	µg/L	ND	6.97E	6.97E	ND	ND	ND	ND	ND
Dimethyl Phthalate			3.26	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl Phthalate			8.59	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Acid Extractable Compounds												
2,4,6-Trichlorophenol			1.75	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol			1.95	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol			1.32	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol			6.07	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol			1.76	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Methyl-4,6-dinitrophenol			4.29	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol			1.88	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol			1.34	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol			3.17	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol			5.87	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Phenol		10	2.53	µg/L	ND	ND	4	ND	ND	ND	3.7	5.3

Table 4-4. La Jolla Ecological Preserve ASBS Stormwater & Ocean Sampling Results

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
2,4,5-Trichlorophenol			1.66	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Tribromophenol				µg/L								
2-Methylphenol			1.51	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol			4.44	µg/L	ND		ND	ND	ND		ND	ND
Microbiology												
Total Coliform	10,000			CFU or MPN/100 Ml		11000	1600E			22000	4500	10E
Fecal Coliform	400	400		CFU or MPN/100 Ml		3000	140E			2300	170E	<10
Enterococcus	105			CFU or MPN/100 Ml			240				490	<10

Legend
NS=Not Sampled
** =Water Quality Objectives for total and dissolved metal fractions based on Total Hardness (as CaCO3)
Exceeds Saltwater Water Quality Criteria according to California Ocean Plan
Exceeds Freshwater Water Quality Criteria according to San Diego Basin Plan
NA = not analyzed' ND = Not detected; E = estimated, qualitative identification without quantitative certainty.
* = Quality control check standards were not within limits. Check samples had recoveries of 124%. The allowable upper limit is 110%.
^ = Cobalt recoveries in blank samples above MDL(MDL= 0.16 uG/L). Also, Replicate analysis relative percent difference (RPD) was greater than 25%

Value is greater than total and exceedes ocean plan total WQO

CTR CCC based on Hardness of >400 (hardness results were not provided)

** = The total PAHs water quality objective is 0.0088 ug/L based on 30-day average

Ammonia as Nitrogen

Low levels of ammonia as nitrogen were detected in all samples across each of the three sampling events (Table 4-4, Table 4-5). However, no samples exceeded the Ocean Plan water quality criteria. Because the Basin Plan water quality objective for ammonia is based on the un-ionized fraction of ammonia. Storm drain sample results for ammonia were calculated as un-ionized ammonia and were compared to the Basin Plan water quality criteria. Neither of the two storm drain samples exceeded Basin Plan criteria for un-ionized ammonia.

Table 4-5. Total and un-ionized ammonia results from storm drain, mixing zone, and offshore samples.

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01			Paseo Dorado 02				Offshore
					Stormdrain-S1		Mixing Zone-D1	Stormdrain-S2			Mixing Zone-D2	
					04/28/05	02/19/06	02/19/06	03/23/05	04/28/05	02/19/06	02/19/06	2/19/06
Total Ammonia (as N)	6		0.2	mg/L	0.89	0.6	0.3	0.94	1.1	0.6	0.3	0.3
Ammonia (Un-ionized)		0.025	-	mg/L	**	0.0019	NA	0.014	**	0.0025	NA	NA

Storm drain sample results compared to the basin plan WQO are calculated from the total ammonia result.

**pH, temp, and salinity results not available for calculation

Synthetic Pyrethroids

No synthetic pyrethroids were detected in any of the samples collected from the storm drains, the mixing zones, or the offshore sites (Table 4-4).

Organochlorine and Organophosphorus Pesticides and PCBs

No organocholorine pesticides or PCBs were detected in any of the storm drain, mixing zone or offshore samples across all three sampling dates (Table 4-4).

Phenols, Phthalates, and Base/Neutral Extractable Compounds

No phenols, phthalates, or base/neutral extractable compounds were detected in any of the samples collected from the storm drains, the mixing zones or the offshore site across all three sampling dates (Table 4-4).

Insert Scripps water quality testing required by their discharge permit

Loading estimates for COCs (copper, turbidity, and bacteria)

Fecal Indicator Bacteria Results

Fecal coliform samples from the S1 and S2 storm drains exceeded Basin Plan water quality criteria (Table 4-6). Mixing zone and offshore samples were each below Ocean

Plan criteria for fecal coliforms. Enterococci concentrations at D1 and D2, however, did exceed the Ocean Plan's criteria of less than 104 MPN/100 mL. The D2 enterococci concentration (490 MPN/100 mL) was twice as high as the D1 concentration (240 MPN/100 mL). Offshore concentrations of fecal coliforms and enterococci were below detection limits. Total coliform concentrations were 11,000 MPN/100 mL and 22,000 MPN/100 mL in S1 and S2 samples, respectively, while D1 and D2 mixing zone samples had concentrations of 1,600 MPN/100 mL and 4,500 MPN/100 mL, respectively.

Table 4-6. Bacterial concentrations from storm drain, mixing zone, and offshore samples.

Constituent	WQO-Ocean Plan	WQO-Basin Plan	MDL	Units	Paseo Grande 01		Paseo Dorado 02		Offshore
					Stormdrain-S1	Mixing Zone-D1	Stormdrain-S2	Mixing Zone-D2	
					02/19/06	02/19/06	02/19/06	02/19/06	2/19/06
Total Coliform	10,000		10	CFU or MPN/100 Ml	11,000	1,600E	22,000	4,500	10E
Fecal Coliform	400	400	10	CFU or MPN/100 Ml	3,000	140E	2,300	170E	<10
Enterococcus	104		10	CFU or MPN/100 Ml		240		490	<10

E indicates an estimated value above the detection limit, but below the reporting limit.

4.1.4.2 Toxicity Results

Acute Test Results

Acute bioassay test results for mysid shrimp exposed to sample water collected from storm drains, mixing zones, and offshore within the ASBS are provided below in Table 4-7. Sample water from the storm drains, mixing zones, and offshore location produced no toxicity to the mysid shrimp, *Mysidopsis bahia.* No observable effect concentrations (NOECs) were at the highest concentration that was tested for each of the water samples. Due to the salinities of the samples falling outside of the acceptable test range for *M. bahia*, salinity adjustments were necessary according to USEPA testing methods. As a result, a brine solution was added to samples with low salinities and a diluted saline solution was added to samples with high salinities. Consequently, the maximum concentration for which the samples could be tested in acute tests with this species ranged from 65 to 75 percent. Although no toxicity was detected, because the NOEC values were not greater than 100 percent test concentration, the Basin Plan criteria was not met for storm drains samples from S1 and S2. Similarly, acute toxic units (TU_as) ranged from 0.82 to 0.91, but despite a lack of toxicity in acute tests with *M. bahia*, did not meet the Ocean Plan criteria of less than 0.3 toxic units.). It should be noted that these results do not indicate any form of toxicity in the sample but instead are explained by the fact that the maximum sample concentration tested in this study was not 100 percent. The sample concentrations were less than 100 percent as a result of the need to adjust the sample salinities in order to properly run acute toxicity tests with *M. bahia*. Thus, because the maximum sample exposure concentrations were equivalent to the NOEC values no toxicity occurred in any urban runoff water samples collected near or offshore from La Jolla storm drains.

Table 4-7. Acute toxicity results for mysid shrimp (*Mysidopis bahia*) exposed to La Jolla Shores water samples.

Sample	Water Quality Standard (TU_a)	Acute *Mysidopis bahia* Bioassay			
		TU_a	NOEC (%)	LOEC (%)	Maximum Concentration of Sample Tested (%)
Storm Drain S1	NOEC>100	0.87	70	>70	70
Mixing Zone D1	>0.3	0.82	75	>75	75
Storm Drain S2	NOEC>100	0.91	65	>65	65
Mixing Zone D2	>0.3	0.82	75	>75	75
ASBS Offshore	>0.3	0.82	75	>75	75

Chronic Test Results

Chronic bioassay test results for mysid shrimp, giant kelp, and sea urchins exposed to sample water collected from storm drains, mixing zones, and offshore within the ASBS

are provided below in Table 4-8. For chronic testing, only the S2 storm drain sample, D2 mixing zone sample, and the offshore sample were used, as these represented the majority of the urban runoff entering into the ASBS.

Giant Kelp- Germination and Growth Endpoints

No toxicity was observed in chronic toxicity tests for germination and growth using the giant kelp *Macrocystis pyrifera* (*M. pyrifera)* in the ASBS offshore sample (Table 4-8). The NOEC was 100 percent of the sample concentration for germination while the LOEC and the Effect Concentration needed to inhibit germination by 50 percent (EC_{50}) was greater than 100 percent. Similar results were observed for the growth endpoint. The kelp growth NOEC was 100 percent of the sample concentration, while the LOEC and EC_{50} values were greater than 100 percent of the sample concentration. The calculated toxic units chronic (TU_c) value of one met the water quality criteria outlined in the California Ocean Plan and demonstrated that there was no toxicity in this water sample.

In the kelp germination test for the storm drain sample, the NOEC value was determined to be 60 percent of the sample concentration, while the LOEC and LC_{50} values were determined to be greater than 60 percent of the sample concentration. As was the case in the acute testing with *M. bahia*, salinity adjustments were required to bring the sample within the acceptable salinity range for this test species (*M. pyrifera*). Because of this, a 60 percent sample concentration was the maximum concentration that could be tested. Thus, although the TU_c of 1.67 exceeded the San Diego Basin Plan criteria of a $TU_c = 1$, no real toxicity was observed. Slight toxicity was observed, however, in the chronic toxicity test using *M. pyrifera* growth as an endpoint in exposures to the storm drain sample. Specifically, the NOEC was less than 6.25 percent, the LOEC was 6.25 percent, and the TU_c was greater than 16. However, because the EC_{50} value was greater than 60 percent (i.e. the highest concentration tested due to salinity adjustments) and the embryos in the 60 percent samples were only 10 percent smaller than the control embryos, toxicity to *M. pyrifera* in chronic exposure to storm drain water was considered slight.

Table 4-8. Chronic Toxicity Results for giant kelp, mysid shrimp, and sea urchins exposed to La Jolla Shores water samples.

Chronic Toxicity Tests						
Test	**Sample**	**Endpoint**	**NOEC (%)**	**LOEC (%)**	**EC50 (%)**	**TUc**
Macrocystis pyrifera (Giant Kelp)	Storm Drain	Germination	60	>60	>60	1.67
		Growth	<6.25	6.25	>60	>16
	Mixing Zone	Germination	6.25	12.5	>100	16
		Growth	25	50	>100	4
	ASBS Offshore	Germination	100	>100	>100	1
		Growth	100	>100	>100	1
Mysidopsis bahia (Mysid Shrimp)	Storm Drain S2	7-Day Survival	65	>65	>65	1.54
		Biomass	65	>65	>65	1.54
	Mixing Zone D2	7-Day Survival	75	>75	>75	1.33
		Biomass	75	>75	>75	1.33
	ASBS Offshore	7-Day Survival	75	>75	>75	1.33
		Biomass	75	>75	>75	1.33
Strongylocentrotus purpuratus (Purple Sea Urchin)	Storm Drain S2	Proportion Fertilized	50	60	>60	2
	Mixing Zone D2	Proportion Fertilized	100	>100	>100	1
	ASBS Offshore	Proportion Fertilized	100	>100	>100	1

Value above Ocean Plan WQO (applies to mixing zone and offshore samples only)

Chronic tests on the mixing zone sample using *M. pyrifera* also resulted in slight toxicity, measured as reductions in growth and germination. The NOEC value for germination was 6.25 percent sample concentration, while the LOEC was 12.5 percent sample concentration. The TU_c was calculated to be 16, which exceeds the water quality standard of $TU_c = 1$. However, because the EC_{50} value for germination was greater than 100 percent, and germination in the 100 percent sample concentration was less than 9 percent lower than germination in control samples, toxicity was considered to be relatively low. For the growth endpoint, TU_c was calculated to be 4, the NOEC was 25, the LOEC was 50, and the EC_{50} value was greater than 100 percent sample concentration. Thus, a slight reduction in growth of *M. pyrifera* embryos occurred as a result of exposure to water from the mixing zone.

Mysid Shrimp- Mortality and Biomass Endpoints

In chronic test exposures to storm drain, mixing zone, and offshore samples, *Mysidopsis bahia* did not have statistically significant reductions in biomass or mortality (Table 4-8). As a result, the NOECs for all of the samples were equivalent to the maximum

concentration of sample tested (ranging from 65 to 75 percent), while the LOECs and EC_{50}s for all samples were greater than the maximum concentration of sample tested (i.e., greater than 65 to 75 percent). Similar to acute toxicity tests, samples collected near the storm drain, in the mixing zone, or offshore, had salinities above or below those used in acute toxicity tests with *M. bahia.* Consequently, salinities were adjusted according to USEPA protocols prior to test initiation as described above. Because of these salinity adjustments, the maximum concentration of sample that could be tested in acute tests with this species was 65 to 75 percent. Despite any observed toxicity, the calculated TU_c values ranged from 1.33 to 1.54, and thus samples collected in the mixing zone and offshore (i.e., La Jolla 02 MZ and ASBS Offshore) were slightly elevated above Ocean Plan water quality standards (TU_c less than or equal to 1). Similarly, for the sample collected near the storm drains (i.e., La Jolla Prsv 02), NOEC values were slightly above water quality standards outlined in the San Diego Basin Plan (NOEC greater than 100 percent). These exceedances of the water quality standards are considered artificially high due to necessary salinity adjustments and subsequent reductions in sample concentrations tested in this investigation.

In chronic toxicity tests using the purple sea urchin, *Strongylocentrotus purpuratus*, no sublethal toxicity, measured as percent fertilization of eggs, was observed in exposures to samples collected in the mixing zone or at the offshore site. Specifically, the NOECs for these samples were 100 percent of the sample concentrations, and the LOECs and EC_{50}s were greater than 100 percent, while and the calculated TU_cs were 1. In the sample collected near the storm drain, slight sublethal toxicity was observed. For this sample the NOEC value was 50 percent of the water sample, the LOEC was 60 percent of the sample, and the EC_{50} was greater than 60 percent of the sample. As a result, the TU_c was calculated to be 2 and the storm drain sample was determined to exceed the Ocean Plan water quality standard.

4.1.5 Constituents of Concern (COCs)

The chemical and biological results presented in the previous sections indicate that the primary contaminants of concern contained in the wet weather storm drain runoff from the La Jolla Shores watershed are turbidity, copper (total and dissolved), and fecal indicator bacteria (fecal coliform and enterococcus). In three wet season sampling events conducted over a one year time period, these were the only constituents that were found to be in exceedance of current San Diego Basin Plan and/or California Ocean Plan criteria.

Turbidity and Sedimentation
Turbidity may be a primary reason that toxicity was observed in the chronic kelp test targeting the growth endpoint in embryos exposed to storm drain and mixing zone samples. Turbid waters significantly reduce light penetration necessary for phytoplankton and macroalgal growth. The transport of significant amounts of sediment through the storm drain system occurs during each rain event, as evidenced by repeated

burial of sampling equipment mounted in the storm drains from sediment loading. This occurred at both the S1 and S2 locations.

Copper

Copper concentrations within the MS4 were in exceedance of Basin Plan criteria. Total copper levels in 2006 sampling and dissolved copper levels in 2005 sampling at both S1 and S2 locations were elevated above the 30.5 mg/L total copper and 29.3 mg/L dissolved copper objectives listed in the Basin Plan. Mixing zone and offshore concentrations did not exceed Ocean Plan criteria.

Fecal Indicator Bacteria

Fecal coliform levels were elevated above Basin Plan criteria within the MS4 at S1 and S2 and mixing zone concentrations of enterococci at D1 and D2 were in exceedance of Ocean Plan criteria. It should be mentioned that the shoreline in the Scripps hydrologic area was placed on the 2002 303(d) list for impaired water quality due to the presence of bacterial indicators but has since been deleted from the list in the draft version of the 2006 list. Fecal indicator bacteria are used to identify waters that may be at risk for disease-causing pathogens.

Owen, C. A. 1981. *Copper deficiency and toxicity: acquired and inherited, in plants, animals, and man.* Noyes Publications, New Jersey

USEPA 2006. http://www.epa.gov/R5Super/ecology/html/toxprofiles.htm